

“I Miss My Liver.” Nonmedical Sources in the History of Hepatocentrism

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Hepatocentrism was a medical doctrine that considered the liver the center of the whole human being. It originated in ancient populations (Mesopotamic civilization) and persisted in Western countries until the seventeenth century. Hidden references to hepatocentrism may be found in artistic representations and literary works, from the myth of Prometheus in the Greco-Roman world to the crucifixion iconography throughout the Middle Ages. In the mid-1600s, fundamental discoveries irrefutably demonstrated the central role of the heart in human physiology, which laid the foundations for creating cardiocentrism, shifting the life's center from the liver to the heart. The advent of cardiocentrism immediately restricted the importance given to the liver, favoring the heart in the fine arts. Nevertheless, the liver maintained its importance in literature and popular belief as is evidenced by the widely acclaimed literary texts “Snow White” by the Brothers Grimm, “Moby Dick” by Herman Melville, and “Ode to the Liver” by Pablo Neruda. Our aim is to analyze the most significant artistic representations and literary works that contain references to hepatocentrism, evaluating the changing ideas and beliefs regarding the role and function of the liver throughout history. We want to underline the tight relationship between art and medicine; fine art and literature could be a valuable source for understanding the history of hepatology. (*Hepatology Communications* 2018;2:982-989)

Until the seventeenth century, the liver was believed to be the origin of blood. This was based on a misconception of Greco-Roman physiology, mainly originating from Galen (c. 129-216), who described this organ as warm and moist, the “source of the veins and the principal instrument of blood production.”⁽¹⁾ Several ancient scholars assumed that a fire perpetually burned in the liver, leading them to consider it the seat of the human soul. This theory was commonly known as hepatocentrism because the liver was considered the center of the whole organism and the origin of life. These beliefs had persisted for almost 4,000 years, from the third millennium Before Christ (BC) until the seventeenth century, when new anatomic and physiologic studies demystified the role of the liver in blood production and raised awareness on the importance of the heart in systemic circulation.⁽¹⁾

The history of hepatocentrism can be analyzed throughout nonmedical sources, particularly literature

and the fine arts. It is interesting to note that many of the medical facts revealed by nonmedical artistic works are missing from medical manuscripts of the same era; this highlights the importance of considering these in the history of medicine. Collectively, these theories have raised discussion among academic researchers, detailed investigation of which may offer interesting contributions not only to scholars with an interest in the history of medicine but also to practising clinicians. The aim of this paper is to evaluate the changing ideas and beliefs regarding the role and function of the liver by analyzing references to it in crucial literary and artistic works (nonmedical sources) throughout history.

Hepatocentrism in Etymology

In 2011, Riva et al.⁽²⁾ gave evidence that the etymology of terms commonly used to indicate the liver in

Abbreviation: BC, Before Christ

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modern languages might provide important information on the significance attributed to this organ in past populations. The term “hepa,” which is the basis of the scientific words used to describe items related to the liver, such as “hepatitis” and “hepatology,” derives from the Ancient Greek word “hèpar” (ἥπαρ), which according to Tiniakos et al.⁽³⁾ may arise from the word “hedoné” (ἡδονή), meaning “pleasure.” In being one of the key emotions experienced by the human soul, “pleasure” alludes to this initial belief that the liver housed the human soul with its complex emotions. Indeed, as aforementioned, Galen described the liver as a warm and moist organ that held the fire that burned perpetually in the human body. So, in ancient physiology, the heat of the liver was thought to be the origin of the human spirit that travelled into the brain by way of the heart.⁽¹⁾ The connection between liver and warmth is well evidenced in the Latin term “iecur.” In detail, ancient Romans indicated the liver with this word, which Isidore of Seville (560-636) connected to another Latin word, “ignis” (i.e., fire).⁽²⁾ According to the theory of the four elements by the Greek philosopher Empedocles (c. 490-c. 430 BC), fire was mostly present in the yellow bile, which was said to reside in the liver. It should be mentioned that the Latin word “iecur” has now disappeared in modern Romance languages; indeed, the term “fegato” (Italian), “foie” (French), and “higado” (Spanish) derive from the Latin adjective “ficatum,” used to indicate the liver of an animal fattened with figs.⁽²⁾ Finally, the English term “liver” seems to derive from the Anglo-Saxon word “lifere.” Similar words to indicate the liver can be found in other Northern European languages, such as German (“Leber”), Icelandic (“lifur”), Dutch, Swedish, Danish, and Norwegian (“lever”). All of these terms, including the Anglo-Saxon word “lifere,” seem to closely resemble the English verb “to live,” underscoring the relation of the liver to life in populations influenced by the Celtic culture.⁽⁴⁾ In conclusion, etymologic analysis

of the terms used in modern languages to indicate the liver seems to confirm the importance of this organ in past cultures and the central role that populations attributed to it in the life of individuals.

Hepatocentrism in Ancient Populations

Hepatocentrism was initially developed in the Mesopotamian populations where the liver was considered the central organ of the human body, the venue of life, soul, emotions, and intelligence.⁽²⁾ Among the Babylonians, interest in this organ increased with the development of a kind of divination, called haruspicy, which was based on the inspection of the viscera, especially livers (hepatoscopy), of sacrificed animals. The liver was chosen for inspection as a natural consequence of the belief that the human soul resided in that organ. Indeed, the liver seemed to be the organ that was largest and most abundant in blood in the whole body, and for this reason it was more frequently analyzed. The Etruscans were also well known for the practice of divining beside the entrails of sheep. Fine arts can confirm this ancient practice; clay or bronze models of sheep livers used by priests were discovered in Mesopotamia as well as in Italy.⁽²⁾ The liver was also an important organ among Ancient Egyptians who removed it from the corpse prior to mummification. They placed this organ in canopic jars decorated with the figure of the god Imsety, whose role was to protect the liver itself and to support the revivification of the corpse. Unlike the ancient civilizations, Egyptians believed that the heart was the seat of the soul (cardiocentrism) and therefore left it inside the corpse after the mummification so that it would guarantee the passage of the spirit to the afterlife, keeping the person alive eternally.

The Hebrews were very familiar with haruspicy, as evidenced in some passages of the Bible: “For the king

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of Babylon stands at the parting of the road, at the fork of the two roads, to use divination: he shakes the arrows, he consults the images (terâphîm), he looks at the liver" (Ezekiel 21:21). It comes as no surprise that the Mesopotamian culture influenced their beliefs on the liver during the Babylonian exile (sixth century Before Common Era). The word "kâbhêdh" (כַּבֵּד), indicating the liver, is etymologically related to the idea of "weight" because anatomically the liver is the heaviest organ in the human body. It was seen as the seat of life as well, evidenced in another passage of the Bible describing the metaphorical fate of one lured by a harlot, "till an arrow struck his liver" (Proverbs 7:23). It was also the seat of all the emotions, as clearly appeared in this passage: "Mine eyes do fail with tears, my bowels are troubled, my liver is poured upon the earth, for the destruction of the daughter of my people" (Lamentations 2:11).

Mesopotamian culture also influenced the Greco-Roman world, which inherited the concept of hepatocentrism, as may be noted by analyzing other nonmedical sources, such as the famous myth of Prometheus and his immortal liver.^(3,5) According to Hesiod (eighth century BC) and Aeschylus (fifth century BC), Prometheus was a mythical gigantic creature, a Titan, who helped humankind by initiating it in the arts and science. Prometheus stole the fire from Zeus' safekeeping and gave it back to the mortal humans. As punishment, Zeus banished him to Mount Caucasus and condemned him to being chained while an eagle devoured his liver all day

(Fig. 1). Prometheus' liver had the ability to regenerate every night, thus enabling eternal torture. Based on this myth, several authors assumed that the ancient Greeks knew about the liver's regenerative powers.⁽⁶⁻⁸⁾ In fact, the immortality of this Titan's liver can be interpreted as being derived from the belief that it held his immortal soul.⁽²⁾ Ancient Greeks could not have known about liver regeneration because their anatomic and physiologic knowledge was based on hepatoscopy, which focused exclusively on the liver's surface appearance. Observing the shape, structure, and color of the liver was clearly insufficient to learn about its regenerating capacity, which was discovered only by nineteenth-century scientists through advanced knowledge of anatomy and microscopic studies.⁽⁹⁾ Therefore, it seems unlikely that the choice of liver as the eagle's target was based on the conception that it was able to regenerate but rather because it was believed to be the seat of life; because Prometheus was immortal, so was his liver.

In addition, the less known Tityus' myth can once again display Ancient Greece's conception of the liver's immortality. Tityus was a gigantic mythical creature who was born from Zeus and Elara, the daughter of King Orchomenus.^(3,5) The god decided to hide the pregnant mother deep inside the earth so that his wife Hera would not learn of his infidelity. There, Tityus was born and nursed by the earth itself. His eagerness for power led him to forcibly occupy the ancient city of Panopeus in Phocis. There he assaulted the Olympian goddess Leto, attempting to rape her, while she was on her way to the oracle in Delphi. Leto called for help from her two children Apollo and Artemis. Both came to her rescue and tried to kill Tityus. As he was immortal, Zeus was compelled to impose on him a punishment. Tityus was bound to Hades, where every new moon two vultures would feed on his liver, which was capable of regenerating, thus enforcing infinite suffering.^(3,5) Incidentally, it should be mentioned that the idea of vultures, renowned for feeding only on dead animals, eating the flesh of a living individual appears to be erroneous.

Nevertheless, the concept of liver as the seat of life also occurred several times in the epic poem "Iliad," traditionally attributed to Homer. The Greek poet described several war wounds in striking details; it comes as no surprise that all liver injuries he described were fatal. For instance, the Greek hero Achilles slit open Tro's liver "that spurted loose, gushing with dark blood [...] and his life breath slipped away" (Iliad, XX, 530-533). Moreover, in the same poem, Hecuba, queen of Troy, declared that in revenge for the murder of her son



FIG. 1. Atlas holding up the sky and Prometheus bound with an eagle picking out his liver, c. 555 BC, Arkesilas Painter, (fl.c. 565-555 BC), Vatican Museums and Galleries, Vatican City.

Hector, she might be able to devour Achilles' liver (Iliad, XXIV, 209-213).⁽¹⁰⁾ In addition, according to the Greeks, one mortally wounded is often defined as "struck in the liver" because it was considered the venue of life.⁽¹¹⁾

The liver also seems to be related to the concept of life in the Arab culture, as demonstrated by the much-discussed tale of Hind bint 'Utbah. She was an Arab woman who lived in the late sixth and early seventh centuries Common Era and accused of cannibalism because she ate the liver of Hamza, the uncle of Islamic prophet Muhammad. This episode shows cannibalistic rituals in pre-Islamic Arabia mainly focused on the liver as it was the seat of life. The Arab culture influenced Islamism, so prophet Muhammad was said to use the term "moist liver" to refer to the soul.⁽¹²⁾ On an occasion of great sorrow, the prophet is said to have wept all night "as though his liver would crack," in the same way as today we would say "as though his heart would break."⁽¹¹⁾ Furthermore, among the Berbers of North Africa, a true depth of affection or emotion is expressed during the ritual betrothal dance by saying, "You are my liver," meaning "you are the best thing about me, the most precious one."⁽¹³⁾ As mentioned by Reuben, even in modern North Africa, a popular Arabic expression is "Istahisht kibdati" ("I miss my liver"), meaning "I miss my child."⁽¹³⁾

Finally, the role of the liver in ancient cultures and people outside the Mediterranean Basin deserves to be remembered. In ancient Chinese medicine, the liver was considered the seat of anger and tear formation, while the gallbladder was said to be the seat of courage.⁽¹⁴⁾ Similarly, in Persian and Urdu traditional medicine, the liver was the seat of courage and desire.⁽¹⁵⁾ In populations of Mesoamerica, the liver was the seat of one of three components of the human soul ('ihiyotl' in the liver, 'tonalli' in the head, and 'teyolia' in the heart). Ihiyotl held passion and aggression, while the other components of the soul were related to consciousness (teyolia), willpower, and intelligence (tonalli).⁽¹⁶⁾ The liver was connected to Mictlan, the underworld, and was associated with Mictlantecuhtli, the god of the dead in Aztec mythology. The latter is dramatically represented with flesh wide open below his chest; coming out of the open flesh in the stomach, a great liver appears.⁽¹⁶⁾

The Central Role of the Liver in the Middle Ages

Scholars appear to have neglected the analysis of the liver in the Middle Ages. During those centuries,

the artistic representation of the Crucifixion, the most important symbol of Christianity that shows the redemption of the entire humanity through Jesus' sacrifice, recurrently contains a subtle reference to hepatocentrism, i.e., the wound in Christ's flank. According to the Gospel of John, the Romans planned to break Jesus' legs, a practice known as *crurifragium*, which was a method of hastening death during a crucifixion.⁽¹⁷⁾ They actually realized that Jesus was already dead and there was no reason to break his legs. A soldier stabbed him in the side to make sure that he was dead: "one of the soldiers pierced his side with a lance, and immediately there came out blood and water" (John 19:34). The phenomenon of blood and water was perceived as a miracle. In the allegorical interpretation, blood symbolizes the humanity of Christ and water His divinity; Jesus was both true God and true Man. This concept is also underlined during the Catholic Mass when the priest pours a small amount of water into the wine before the consecration. This act symbolizes both Christ's humanity and divinity, recalling the production of both blood and water from Christ's side on the cross. The Gospel did not indicate the side where Christ was wounded, but tradition places the injury between the eighth and ninth ribs of the right side, which is also represented in different works of art across the centuries. The crucifixion iconography appears to be deeply influenced by contemporaneous hepatocentrism such that the liver, considered the origin of life in Greco-Roman medicine, seems to be the target of the Roman soldier. In the "Crucifixion" (c. 1368-1370) by the Florentine painter Jacopo da Cione (1325-1399), the wound is depicted in the lower part of the right hemithorax where it may be inferred to affect the liver. The same depiction is repeated by more renowned and prestigious artists, such as Giotto (c. 1270-1337), where the same point is stabbed, for example, in the "Crucifix" of Santa Maria Novella (c. 1290-1295) (Fig. 2). This iconography is true not only in the work of Italian artists but also those who came from Northern Europe, as shown in the "Diptych with Calvary and Last Judgement" (1430-1440) by the Flemish painter Jan van Eyck (c. 1390-1441). The tradition of this particular position continued throughout the Middle Ages such that it can be found in all the most famous Renaissance artists, such as Andrea Mantegna (1431-1506) in his "Crucifixion from the high altar of San Zeno" (1457-1459) and Masaccio (1401-1428) in the "Crucifixion from the Pisa Altarpiece" (1426). During the Baroque period, Caravaggio (1571-1610) provided further details on the wound in the liver

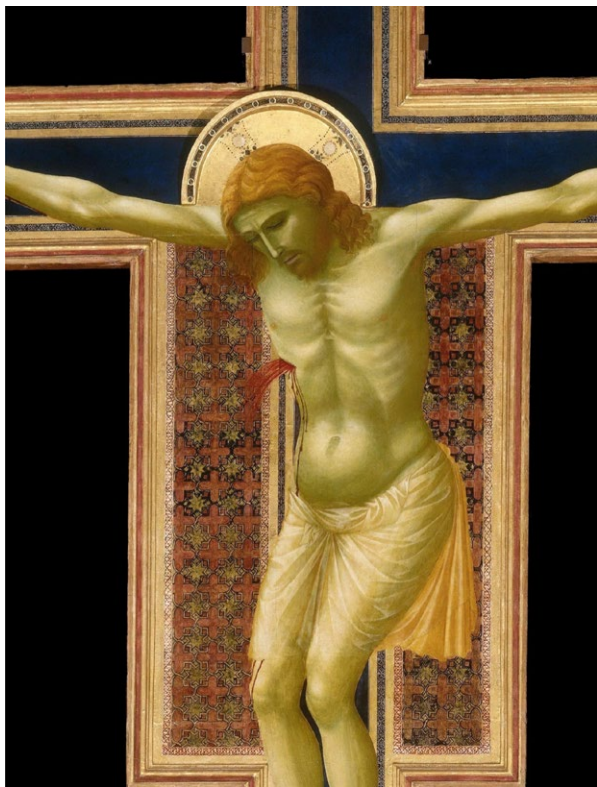


FIG. 2. "Crucifix" (c. 1290-1295) (detail) by Giotto, Santa Maria Novella, Florence, Italy.

of Christ. In his "The Incredulity of Saint Thomas" (1600-1601), Caravaggio represented the apostle Saint Thomas putting his finger inside resurrected Christ's wound (Fig. 3). A noteworthy detail is the orientation in which the finger enters the wound; this gives us an idea of the direction of the stab, not obliquely and superiorly toward the heart but almost perpendicular to the body's surface, in a transverse direction pointing to the liver. Even if Caravaggio did not represent a classical crucifixion scene, his work confirmed the location of Christ's wound as being centered on the liver.

The relationship between liver and soul in Christianity could also be evidenced in the metaphor of the "thirsty dropsy."⁽¹⁸⁾ The tragically ironic correlation between fluid overload and unquenchable thirst, which was observed by ancient physicians, was used in nonmedical literary works as a metaphor for greed in the depiction of moral and philosophical matters regarding the human soul. In his "De Scripturis," the bishop Augustine of Hippo (354-430) compared greed, a disease of the soul, and dropsy, a disease of the flesh; what the sufferer wants, respectively, money

or water, only aggravates their condition.⁽¹⁸⁾ This metaphor is maintained throughout the centuries and can be notably found in the figure of Mastro Adamo, in "The Divine Comedy" by the Italian poet Dante Alighieri (1265-1321). Inspired by the parallel between thirst and ascites found in classical antiquity, Dante describes his meeting, during his fictitious journey to hell, with the counterfeit Mastro Adamo who suffers from "dropsy."^(19,20) The Italian poet describes the unquenchable thirst of this character who himself recognizes that drinking water worsens his edema ("ché s'i' ho sete e omor mi rinfarcia," *Inferno*, XXX, 126). Despite the literal physical disease described, Dante uses Mastro Adamo to embody and symbolize avarice. According to Smith, he suffers from eternal "thirsty dropsy" as punishment for his sins as a forger of money.⁽²¹⁾

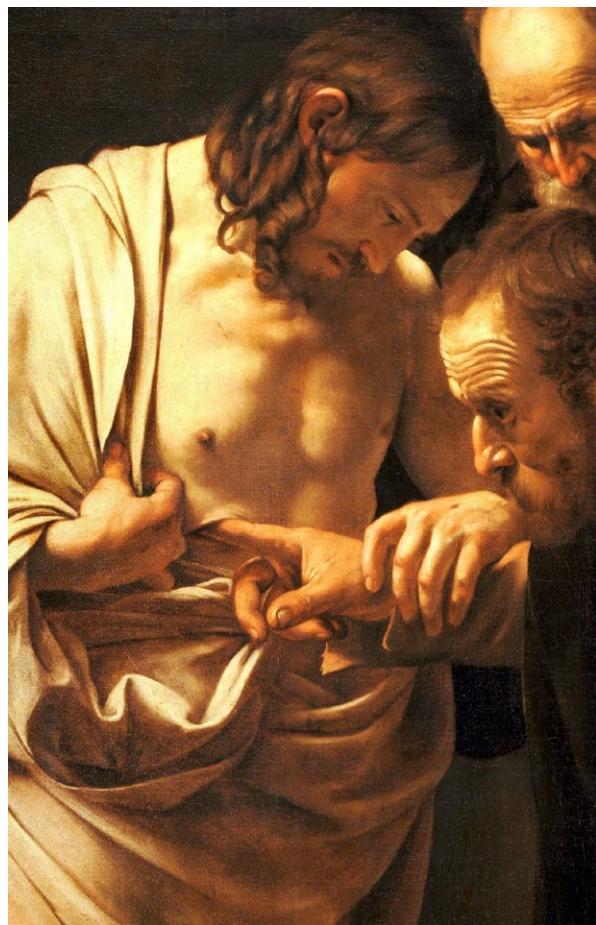


FIG. 3. "The Incredulity of Saint Thomas" (1600-1601) (detail) by Caravaggio, Bildergalerie, Potsdam, Germany.

The Modern Age Dethrones the Liver

As was described earlier in this article, Galenists had long believed that venous blood was produced in the liver from food absorbed in the digestive system and used up in the body.⁽¹⁾ Around the 1650s, anatomists, such as William Harvey, made key discoveries in medical anatomy and physiology, including the existence of the lymphatic and systemic circulatory systems.^(22,23) These important realizations led to the unequivocal rejection of the longstanding ideas regarding the role and function of the liver, which were thereafter attributed to the heart (cardiocentrism).

This milestone in the history of medicine is described in the seventeenth-century painting “Il Fegato” (“The Liver”), which today is held at the Museo Storico Nazionale dell’Arte Sanitaria in Rome and is believed to have belonged to Giovanni Guglielmo Riva (1627-1677), one of the most distinguished Italian surgeons of that time.⁽¹⁾ This painting shows an individual with an open abdomen that has been dissected to show the liver; the individual is holding a parchment with an ode retired on an anatomic stage where Liver and Heart fight for the glory of being king among the human organs, the one that produces blood. Not only does this painting recount the developments in medical physiology at the time, it also gives us an allusion to the emotionally charged atmosphere surrounding this change in opinion in the scientific community, which is as usual translated to the artistic world.

It is interesting to note how despite this irrevocable discovery regarding the role of the heart and liver, the liver was still highly regarded and did not entirely lose its claim to be the seat of the human soul in popular myths and notorious literature work. In the fairy tale “Snow White” (“Schneewittchen” in German), written by Jacob (1785-1863) and Wilhelm Grimm (1786-1859) in 1812, the evil queen demands the huntsman kill Snow White and bring her lungs and liver to undoubtedly ascertain her death.⁽²⁴⁾ In the acclaimed 1937 Disney movie “Snow White and the Seven Dwarfs,” based on this fairy tale, the evil queen demands Snow White’s heart. With today’s medical knowledge, this makes sense as the heart is central to humans’ immediate survival. The original version by the Brothers Grimm shows that during the nineteenth century, popular medicine held that the human spirit was housed in the liver, which was believed to play a role in sustaining life.

Another noteworthy example of how the liver somewhat maintained its importance in popular medicine after the discovery of systemic circulation may be found in a distinguished literary piece in the modern era. In his masterpiece “Moby Dick” (1851), the American writer Herman Melville (1819-1891) used the liver to symbolize human emotions. In detail, the expression “white liver” is used in the book to describe someone who lacks courage.⁽²⁵⁾ This expression does not seem to be directly connected to the anatomic and physiologic discoveries regarding the liver at the time (nineteenth century), rather it is most likely a reflection of the belief in the Classical era that the liver housed one’s blood, hence courage.

Indeed, a similar expression (“lily-liver”) can be found during the seventeenth century when William Shakespeare (1564-1616) described the fear and cowardice of a servant, defining him as “Lilly-liver’d Boy” (“Macbeth,” Act V, scene 3, 20). The English poet used the same metaphor in “The Merchant of Venice,” when Bassanio stated “have livers white as milk” (Act III, scene 2, 86). It is interesting to note that modern society still uses the liver to express human emotion and characteristics, as the French expression “avoir les foies blancs” (“to have the white liver”) to signify cowardice or the Italian “avere fegato” (“to have liver”) to indicate courage. Similarly, references to liver and bile also appear in many other languages (e.g., Estonian, Japanese, and Chinese) as a metaphor for bravery, anger, arrogance, and other emotions and moods.^(13,14) Curiously, Mellinkoff postulated that the connection between courage/cowardice and liver in different cultures and populations could be related to the bitter taste of bile.⁽¹⁴⁾

Conclusions

In this brief journey through history, from the Classical Age to today, we have discussed the evolution of beliefs concerning the role and functions of the liver by analyzing nonmedical sources.

In the history of art, the liver, considered the seat of soul in Medieval and Early Modern Age medicine, as influenced by the Greco-Roman physicians, was represented as the target of the Roman soldier’s lance in the representation of the crucified Christ. His side wound alludes to the myths of Prometheus and Tityus, whose livers were eternally destroyed during the day and regenerated each night; this symbolized immortality, which was in the power of the liver, seat of the soul.

It should come as no surprise that Renaissance and Baroque artists were fascinated by the myths of Prometheus and Tytius, as shown by “Tytius in Chains” by Gregorio Martinez (1547-1598), by “Prometheus Bound” by Peter Paul Rubens (1577-1640), and by “The Punishment of Tythus” by Titian (c. 1488-1576). When medical knowledge on the liver and its functions changed and hepatocentrism theory declined, society started to modify its beliefs and convictions and artists changed the representation of the crucifixion episode. Therefore, the sunset of hepatocentrism coincided with the decrease in artists’ interest in Christ’s side wound, which completely disappeared in the crucifixion iconography. Instead, attention shifts to a focus on the wounds in his hands and feet, as well evidenced in “Crucifixion” (1880) by the American painter Thomas Eakins (1844-1916). Since the 1600s, the development of cardiocentrism in medicine has also influenced the religious cult, as testified by the Catholic devotion to the “Sacred Heart,” already developed in the Middle Ages but fostered in that period by the bishop of Geneva Francis de Sales (1567-1622) and by the nun Margaret Mary Alacoque (1647-1690). The painters seem to neglect the liver, which disappears from their works in modern times, while the heart (and its relationship with love) appears to become a more attractive subject for artists. In modern art, only the Armenian-American painter Arshile

Gorky (1904-1948), one of the fathers of Abstract Expressionism, focused on the liver in one of his works (“The Liver is the Cock’s Comb,” 1944) (Fig. 4).

In the history of literature, the belief of the liver as the seat of emotions and passion has persisted throughout the centuries. Indeed, this concept may be found in the Middle Ages (Dante) and Early Modern Age (Shakespeare) and also in nineteenth-century writers (Brothers Grimm, Melville). The influence of modern hepatology on literature can be evidenced in the “Ode to the Liver,” written by the Chilean Nobel laureate poet Pablo Neruda (1904-1973). As mentioned by Arrese, Neruda composed the ode after an encounter with liver researcher Hector Orrego; it was published in 1956 in a book entitled “Nuevas odas elementales” (New Elemental Odes).⁽²⁶⁾ Orrego explained the modern knowledge on the physiology of the liver to Neruda, and the poet reported this in his ode. He praises his liver as a “noiseless machinery,” knowing that if “one tiny cell / be in error / or one fiber be worn / in your labor / and the pilot flies into the wrong sky / the tenor collapses in a wheeze / the astronomer loses a planet.” At the end of the ode, the author underlines the tight relationship between life and the liver’s function: “I love life: Do not betray me! Work on! / Do not arrest my song.”⁽²⁶⁾ The ode appears to be a modern version of the aforementioned seventeenth-century painting “Il Fegato” in Rome.



FIG. 4. “The Liver is the Cock’s Comb” (1944) by Arshile Gorky, Albright-Knox Art Gallery, Buffalo, New York.

In conclusion, the liver is one of the largest human organs, and its size, associated to its richness in blood, undoubtedly influenced popular beliefs across centuries and civilizations on its essential role in human life. Ancient myths in cultures as diverse as Assyrian and Babylonian, Greco-Roman, Hebrew, Aztec, and Chinese showed that the liver was seen as the seat of life and human passion, thereby influencing the development of hepatocentrism in art and literature as well as in medicine. The development of cardiocentrism in medicine during the seventeenth century seems to have limited the importance given to the liver in favor of the heart in the fine arts, in literature, and as a result, more widely in culture. This could result in less attention toward liver disease compared to cardiovascular pathologies in modern society. Therefore, the shift from hepatocentrism to cardiocentrism should be appreciated not only by historians but also by practicing clinicians and scientists who want to increase public awareness of the liver and its diseases.

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